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Chrononutrition and Circadian Physiology: A Biological Perspective on *Ayurvedic Ahara Vidhi Vidhana*

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Abstract

Chrononutrition is the study of the importance of meal timing relative to dietary quality and quantity in the promotion of metabolic health. Recent findings indicate that synchronizing food consumption with the circadian rhythm has consequences for glucose homeostasis, insulin sensitivity, hormonal regulation, digestive physiology and cardiometabolic health. In addition, the diet principles are described in *Ahara Vidhi Vidhana* in Ayurveda, which states that one should eat at the right time when the digestive system is ready, in the right quantity and mindfully.

To critically review the evidence on chrononutrition and circadian physiology, and to explore their conceptual association with *Ayurvedic* principles of *Ahara Vidhi Vidhana*.

A narrative review was undertaken based on the scientific literature available in PubMed, Scopus, Google Scholar, AYUSH Research Portal, and classical *Ayurvedic* texts, including *Charaka Samhita*, *Sushruta Samhita*, and *Ashtanga Hridaya*. A narrative thematic approach was used to critically synthesize literature regarding circadian

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physiology, chrononutrition, meal timing, time-restricted eating, metabolic regulation, and *Ayurvedic* dietary principles. Conceptual comparisons were cautiously made between traditional *Ayurvedic* concepts and current biological mechanisms without assuming direct equivalence.

The evidence reviewed suggests that meal timing is an important regulator of circadian and metabolic physiology. Timing food intake with the biological active phase is associated with beneficial effects on glucose homeostasis, insulin sensitivity, lipid metabolism, appetite regulation, and cardiometabolic health, while irregular eating schedules and late-night food intake may lead to circadian misalignment and metabolic dysfunction. The classical principles of Kala Bhojana, Jirne Ashniyat, Matravat Ashniyat and Tanmana Bhunjita have considerable conceptual resemblance with regular meal timing, appropriate feeding–fasting intervals, regulation of the portion size and mindful eating. The *Ayurvedic* concept of Agni may be considered a more general functional construct that includes aspects of digestion and metabolism, but has no direct molecular equivalent in modern physiology.

Chrononutrition and *Ahara Vidhi Vidhana* offer distinct but conceptually convergent perspectives on the temporal organization of dietary behavior and metabolic health. The integration of modern circadian physiology and traditional *Ayurvedic* dietary recommendations may provide a useful interdisciplinary framework for preventive nutrition and generate testable hypotheses for future studies. But these resemblances should be regarded as conceptual and physiological analogies, not as precise scientific equivalence. Experimental, translational and clinical studies are needed to investigate the mechanisms behind them and their clinical application.

Key words : Chrononutrition, Circadian Physiology, Glucose homeostasis, Hormonal regulation, Cardiometabolic health, Ahar Vidhi vidhana.

During the past few decades, the worldwide prevalence of lifestyle-related metabolic disorders such as obesity, type 2 diabetes mellitus, metabolic syndrome, and cardiovascular diseases has increased dramatically. Rapid urbanization, sedentary lifestyle, irregular working schedules, poor sleep and unhealthy dietary habits have contributed a major role for increasing burden of public health. For the most part, conventional nutritional science has been concerned with the quality and quantity of food consumption, but an increasing amount of scientific data suggests that the timing of food intake is another important factor influencing metabolic health. Irregular mealtimes, prolonged eating

windows, constant snacking and late-night eating have been linked to circadian misalignment, impaired glucose metabolism, insulin resistance, chronic low-grade inflammation and increased cardiometabolic risk. Such observations have given rise to chrononutrition, a multidisciplinary field that investigates the interplay between meal timing, biological rhythms, and metabolic regulation, thereby opening up new avenues for disease prevention and health promotion.

The physiological basis of chrono-nutrition is the circadian timing system, an endogenous biological system that synchronizes metabolic and behavioral processes with the circa 24-hr light–dark cycle. The master circadian pacemaker in mammals is the suprachiasmatic nucleus (SCN) of the anterior hypothalamus, which synchronizes peripheral biological clocks present in metabolically active organs including the liver, pancreas, gastrointestinal tract, adipose tissue, skeletal muscle and heart. These central and peripheral clocks orchestrate the timing of a number of physiological processes, including glucose homeostasis, lipid metabolism, hormone secretion, digestive activity, energy expenditure, and the sleep–wake cycle. In order to synchronize central and peripheral clocks, environmental cues—particularly the light-dark cycle and meal timing—are crucial zeitgebers. On the other hand, irregular eating schedules, shift work, sleep deprivation, and late-night eating cause circadian misalignment, which disrupts the clock-controlled metabolic pathways and increases the risk of obesity, insulin resistance, type 2 diabetes, cardiovascular disease, and other metabolic disorders.

Chrononutrition has become an important area of nutritional science, emphasizing that the timing of food intake is just as important as what and how much is consumed. Experimental and clinical studies conducted in recent years have shown that eating in accordance with endogenous circadian rhythms positively affects glucose tolerance, insulin sensitivity, lipid metabolism, appetite control and general metabolic homeostasis, while irregular meal timing and night eating have a detrimental effect on these physiological processes. Dietary strategies such as early time-restricted eating (eTRE), regular meal timing and extended overnight fasting have been shown to reduce cardiometabolic risk via improved circadian synchronization and metabolic efficiency. These findings have led to modern nutritional science to consider not only the composition of nutrients, but also the temporal regulation of food intake as a key determinant of health, highlighting the importance of incorporating meal timing into preventative and therapeutic nutrition strategies.

Even before the era of chrononutrition, Ayurveda had realized the importance of appropriate dietary behavior for the maintenance of physiological balance and health. *Ahara Vidhi Vidhana* of *Charaka Samhita* (Vimana Sthana) is one of the basic dietary principles which gives the total instructions regarding time, amount, quality and manner of food intake and the psychological considerations. These include *Jirne Ashniyat* (eating only after complete digestion of the previous meal), *Kala Bhojana* (timely food intake), *Matravat Ashniyat* (consuming food in an appropriate quantity), and *Tanmana Bhunjita* (mindful eating). They stress that optimal nutrition is not only dependent on the composition of food, but also on the physiological state of the individual and timing of food intake. Also, *Ayurvedic* concepts such as *Agni*, *Dinacharya*

and *Ritucharya* promote the alignment of food habits with the functional status of the body and the natural cycles of the environment. These principles have significant conceptual similarities to current biological notions of circadian regulation, meal timing and metabolic homeostasis. This suggests that the traditional *Ayurvedic* dietary knowledge may provide useful insights into the modern chrononutritional science.

While there is considerable scientific evidence in support of the role of chrono-nutrition and circadian physiology in metabolic regulation and classical *Ayurvedic* literature provides detailed guidelines on dietary practices through *Ahara Vidhi Vidhana*, these two knowledge systems have been explored largely independently. The majority of published reviews have focused either on the biological mechanisms of chrononutrition or on the traditional principles of *Ayurvedic* dietetics, with little emphasis on the conceptual integration of the two from a physiological perspective. However, a holistic synthesis critically examining the biological relevance of *Ayurvedic* dietary principles in the context of circadian physiology, meal timing, and metabolic regulation is still lacking. Bridging this gap may promote interdisciplinary understanding and provide a scientific framework for the exploration of traditional dietary concepts in the context of contemporary biological research.

The present review aims critically evaluate the current evidence on chrononutrition and circadian physiology with these considerations in mind and explore the conceptual relationship with the *Ayurvedic* principles of *Ahara Vidhi Vidhana*. This review seeks to provide a comprehensive physiological perspective on dietary behaviour and its importance to metabolic health, synthesizing current knowledge on biological rhythms, meal timing, metabolic regulation, and classical *Ayurvedic* dietary concepts. It also points to possible areas of interdisciplinary research to support the scientific validation of traditional dietary principles and to develop evidence-based nutritional strategies for the prevention and management of lifestyle-related metabolic disorders.

Review Procedure :

Review Design :

The present study was done as a narrative review to critically review the current evidence of chrononutrition and circadian physiology and its relation to the *Ayurvedic* principles of *Ahara Vidhi Vidhana*. The review integrates modern scientific literature with classical *Ayurvedic* texts to understand meal timing and metabolic regulation from a biological perspective.

Literature Search Strategy :

A systematic literature search was performed on PubMed, Scopus, Google Scholar and AYUSH Research Portal to identify relevant studies published from January 2000 to the last literature search. Classical *Ayurvedic* texts such as *Charaka Samhita*, *Sushruta Samhita* and *Ashtanga Hridaya* were also consulted. The search strategy used was Medical Subject Headings (MeSH), free-text keywords and Boolean operators (AND, OR). The major search terms were chrononutrition, circadian physiology,

circadian rhythm, biological clock, meal timing, time restricted eating, Ayurveda, *Ahara Vidhi Vidhana*, Agni, Dinacharya, Ritucharya and metabolic health. We also manually searched the reference lists of selected articles for additional relevant publications. For the preparation of the manuscript relevant literature[1-42] has been consulted.

Eligibility Criteria and Data Extraction :

Original research articles, review articles, systematic reviews, meta-analyses and relevant peer-reviewed publications on chrononutrition, circadian physiology, meal timing, metabolic regulation and *Ayurvedic* dietary principles were included. Classical *Ayurvedic* texts on *Ahara Vidhi Vidhana*, Agni, Dinacharya and Ritucharya were also considered. Duplicate records, conference abstracts, editorials, letters and non-peer reviewed publications and studies not relevant to the objectives of the review were excluded.

Relevant data on study characteristics, biological mechanisms, metabolic outcomes, circadian regulation and corresponding *Ayurvedic* concepts was extracted and thematically organized for comparative analysis.

Narrative Synthesis :

Selected literature was synthesized through narrative thematic approach. A critical review and comparison of the scientific evidence regarding chrononutrition, circadian physiology, biological rhythms, meal timing, hormonal regulation and metabolic health with the corresponding *Ayurvedic* principles of *Ahara Vidhi Vidhana*. The synthesis highlighted conceptual convergence between modern biological knowledge and classical *Ayurvedic* dietary principles, with the caveat that these are interpretive comparisons, not direct experimental equivalence.

The findings were categorized under major themes such as circadian physiology, chrononutrition, *Ahara Vidhi Vidhana*, comparative biological perspectives and clinical relevance. Thematic organization enabled a comprehensive interpretation of the available evidence and facilitated the development of an interdisciplinary framework integrating modern physiology with *Ayurvedic* dietary concepts.

Institutional ethical approval and informed consent were not required as this article is a narrative review based only on published scientific literature and classical *Ayurvedic* texts.

Circadian Physiology :

An intrinsic biological timing system synchronizes physiological, metabolic and behavioral processes with the approximately 24-hour light–dark cycle and this system regulates circadian physiology. This endogenous timing mechanism enables organisms to anticipate predictable changes in the environment, and to maintain physiological homeostasis internally. The master circadian pacemaker of mammals is the SCN (suprachiasmatic nucleus) of the anterior hypothalamus which entrains peripheral biological clocks in metabolically active tissues such as liver, pancreas, gastrointestinal tract, adipose tissue, skeletal muscle and heart. Communication between the central and peripheral clocks occurs via neural, endocrine and behavioral signals that coordinate

the timing of glucose metabolism, lipid metabolism, hormone secretion, digestive activity, immune responses, body temperature and the sleep–wake cycle. The major zeitgebers that entrain the circadian system and maintain the synchrony between central and peripheral oscillators are environmental cues, especially the light–dark cycle and time of meal intake. Disruption of this synchronized timing system results in circadian desynchrony, metabolic dysregulation, and increased risk of obesity, type 2 diabetes mellitus, cardiovascular diseases, and other lifestyle-related disorders.

Circadian rhythms exert profound effects on metabolic homeostasis via regulation of the timing of glucose metabolism, lipid metabolism, energy expenditure, nutrient absorption and digestive physiology. Metabolism is not a steady state process but rather exhibits predictable circadian oscillations regulated by the central and peripheral biological clocks. In general, insulin sensitivity, glucose tolerance and digestive activity are highest during the daytime, but these physiological functions are suppressed during the evening and the biological nite. Therefore, food consumed during the active phase is metabolized more efficiently than during the resting phase. In contrast, irregular meals, long eating windows and late-night eating desynchronize circadian rhythms, resulting in impaired glucose utilization, increased adiposity, chronic inflammation, insulin resistance and increased cardiometabolic risk. These findings emphasize the importance of aligning dietary behavior with endogenous circadian rhythms in an effort to maintain metabolic health and prevent lifestyle-related disorders.

Circadian regulation of metabolism is achieved by rhythmic secretion of several hormones that coordinate energy balance, appetite, digestion and glucose homeostasis. Among them, cortisol, melatonin and insulin have a pivotal role in coordinating the metabolic activities with the light–dark cycle. Cortisol follows a circadian rhythm, with peak concentrations in the early morning to promote energy mobilization and prepare the body for daytime activity. But, in contrast, melatonin is released mostly at nite and induces sleep but decreases glucose tolerance and insulin sensitivity explaining the adverse metabolic consequences of eating late. Circadian variation is also observed in insulin secretion and insulin sensitivity, with maximal response during the day and reduced efficiency during the evening and nite. Collectively, these hormonal oscillations emphasize that both meal timing and hormonal rhythmicity are essential determinants of metabolic regulation and cardiometabolic health.

At the molecular level, circadian rhythms are regulated by a highly conserved network of clock genes, including CLOCK, BMAL1, PER (Period), and CRY (Cryptochrome), which interact through transcriptional–translational feedback loops to generate approximately 24-hour biological oscillations. These molecular clocks regulate the expression of numerous genes involved in glucose metabolism, lipid metabolism, endocrine function, immune responses, and cellular energy homeostasis. Feeding–fasting cycles serve as important synchronizing signals for peripheral molecular clocks, whereas irregular dietary patterns and circadian disruption alter clock gene expression and contribute to metabolic dysfunction. Increasing evidence suggests that disturbances in these molecular

pathways are associated with obesity, insulin resistance, metabolic syndrome, and type 2 diabetes mellitus. Understanding these mechanisms provides the biological foundation for chrononutrition and explains why the timing of food intake has a profound influence on metabolic regulation. These physiological and molecular insights provide an appropriate scientific framework for understanding the principles of chrononutrition discussed in the subsequent section.

Integrative Biological Framework Linking Circadian Physiology, Chrononutrition and *Ayurvedic Ahara Vidhi Vidhana.*

Chrononutrition :

Chrononutrition is a new interdisciplinary field of nutritional science that investigates the interaction of the timing of meals, circadian rhythms and metabolic physiology. As opposed to traditional nutrition, which focuses primarily on nutrient composition and caloric intake, chrononutrition considers the timing, frequency, and regularity of food intake to be equally important determinants of metabolic health. The concept stems from advances in chronobiology that have shown feeding–fasting cycles to be potent zeitgebers that can synchronize peripheral biological clocks. Thus, timing of food intake has been recognized as a major regulator of glucose metabolism, lipid metabolism, endocrine function, digestive physiology, and energy homeostasis.

During the last 20 years, experimental, epidemiological, and clinical evidence has accumulated demonstrating that alignment of food intake with the endogenous circadian rhythms enhances metabolic efficiency and lowers the risk of obesity, type 2 diabetes mellitus, metabolic syndrome, and cardiovascular diseases. These findings have led to a change in the view of modern nutritional science, from the traditional view of "what to eat" to a more complex view that includes "when to eat", thus making chrononutrition a relevant approach in preventive and therapeutic nutrition.

Biological Basis of Chrononutrition :

Chrononutrition is based on the biological interaction between the circadian timing system and feeding behavior. The central circadian rhythm is controlled by the suprachiasmatic nucleus (SCN) in response to the light-dark cycle, whereas peripheral clocks in the liver, pancreas, skeletal muscle, adipose tissue and gastrointestinal tract are highly sensitive to meal timing. Thus, food intake is not only a source of nutrient but also an important physiological signal for the regulation of peripheral circadian oscillators.

Under physiological conditions, synchrony between central and peripheral clocks results in optimal regulation of glucose homeostasis, insulin sensitivity, nutrient absorption, hormone secretion, digestive activity and energy expenditure. However, this synchronized rhythm is disrupted by irregular eating patterns, extended eating periods, night-shift work and frequent late-night meals, leading to circadian misalignment and impaired metabolic regulation. Circadian system disruption has been linked to insulin resistance, obesity, dyslipidemia, chronic inflammation, non-alcoholic fatty liver disease, metabolic syndrome and cardiovascular disorders. Thus, chrononutrition seeks to

synchronize dietary behavior with endogenous biological rhythms to preserve metabolic homeostasis and reduce the risk of disease.

Meal Timing and Metabolic Health :

Chrononutritional health is greatly influenced by the timing of meals. Physiological studies have shown that insulin sensitivity, glucose tolerance, digestive enzyme activity, and nutrient utilization are highest during the biological day and decrease gradually during the evening and biological nite. Thus, food eaten during the active phase is catabolized more effectively than food eaten during the resting phase.

Regular meal timing facilitates circadian synchronization, maintains hormonal rhythmicity, and improves metabolic flexibility. In contrast, breakfast skipping, irregular meal times, prolonged eating occasions, frequent snacking and late-night eating have been associated with impaired glucose metabolism, increased appetite, weight gain, higher levels of inflammatory markers and increased cardiometabolic risk. These findings suggest that meal timing is an independent determinant of metabolic health independent of diet composition. Hence, the temporal organization of food intake should be considered an essential component of nutritional recommendations.

Time-Restricted Eating (TRE) and Early Time-Restricted Eating (eTRE) :

Time-Restricted Eating (TRE) is a dietary strategy that restricts eating to a certain number of hours of the day, usually 8 to 12 hours, and extends the overnight fast. Unlike conventional calorie-restricted diets, TRE does not restrict total energy intake but modifies the timing of food consumption. Studies in both experimental models and humans have consistently demonstrated that TRE leads to improvements in circadian synchronization, insulin sensitivity, glucose regulation, lipid metabolism, blood pressure, body weight, and overall metabolic health.

Among the various TRE protocols, Early Time-Restricted Eating (eTRE), where the food intake is completed in the earlier part of the day, seems to have better metabolic outcomes due to better alignment of feeding behavior with the endogenous circadian rhythms. The eTRE interventions have been associated with better glycemic control, increased insulin sensitivity, reduced oxidative stress and improved appetite regulation. These findings support the notion that both the length of fasting and the timing of meals are of major importance in the regulation of metabolism independent of caloric intake.

Clinical Implications of Chrononutrition :

Chrononutrition is clinically relevant not only for metabolism regulation, but also for preventive medicine and public health. There is increasing evidence that eating habits in accordance with the circadian rhythm are associated with better glycemic control, improved lipid profiles, lower body weight, lower blood pressure, improved sleep quality and reduced cardiovascular risk. In contrast, irregular meal timing has been related to circadian disruption and its adverse effects including obesity, type 2 diabetes mellitus, metabolic syndrome, gastrointestinal disorders, sleep disturbances and cardiovascular diseases.

Emerging evidence also suggests that chrononutritional interventions, in addition to lifestyle modification, physical activity and conventional dietary management, might improve therapeutic outcomes. Therefore, chrononutrition represents a practical, non-pharmacological strategy for reducing the burden of lifestyle-related diseases and promoting long-term metabolic health.

Although chrononutrition has emerged from modern chronobiology and nutritional science, several of its fundamental principles demonstrate notable conceptual similarities with classical *Ayurvedic* dietary guidelines. The emphasis on proper meal timings, avoiding irregularities in meal timings, sufficient fasting durations and coinciding food intake with physiological rhythms is akin to the *Ayurvedic* principles of Jirne Ashniyat, Kala Bhojana, Agni and *Ahara Vidhi Vidhana*. The conceptual similarities imply that the traditional *Ayurvedic* dietary practices can be understood within the framework of modern circadian physiology without assuming direct equivalence between the two systems.

Relevance to Ayurvedic Dietary Principles :

Chrononutrition is a product of modern chronobiology and nutritional science, yet several of its fundamental concepts exhibit remarkable conceptual overlaps with classical *Ayurvedic* dietary guidelines. The importance of eating meals at regular intervals and not following irregular meal timings, eating at appropriate fasting intervals and synchronizing food intake with physiological rhythms is very much alike the concepts of Jirne Ashniyat, Kala Bhojana, Agni and *Ahara Vidhi Vidhana* in Ayurveda. These conceptual similarities suggest that traditional *Ayurvedic* dietary practices can be framed in terms of modern circadian physiology without claiming a direct equivalence of the two systems.

This evening perspective provides a scientific basis for exploring *Ahara Vidhi Vidhana* in relation to chrononutrition and Provide as a logical transition to the subsequent section of this review.

Ayurvedic Principles of *Ahara Vidhi Vidhana:*

In Ayurveda, food (Ahara) is considered as one of the Trayopastambha (three fundamental pillars of life) and is essential for the maintenance of health, vitality and longevity. The classical *Ayurvedic* texts stress that health depends not only on the quality of the food one eats but also on the timing, the amount, the method of eating, one's digestive capacity and one's mental state at the time of eating. The principles are systematically described under *Ahara Vidhi Vidhana* in the *Charaka Samhita* (Vimana Sthana) where dietary behavior is described as a major determinant of digestion, metabolism, tissue nourishment and disease prevention. Unlike the traditional nutrition which is mainly concerned with the nutrient composition and the caloric intake, *Ahara Vidhi Vidhana* takes a more holistic physiological approach by linking the dietary habits to the digestive function, individual constitution, seasonal adaptation, and behavioural factors.

According to Jirne Ashniyat, a principle of *Ahara Vidhi Vidhana*, food should be consumed only after the previous meal is fully digested. This is to avoid overloading the digestion and to maintain the metabolic function

at its optimum. Kala Bhojana stresses the importance of eating food at proper and regular times as per the physiological needs and the importance of timings of meals. Matravat Ashniyat prescribes eating food in appropriate amount according to digestive capacity and hence prevents the ill effects of overeating and undernutrition. Ushnam Ashniyat recommends consuming freshly prepared warm food to aid digestion and enhance gastrointestinal function, while Tanmana Bhunjita recommends mindful eating with complete mental focus, minimizing emotional and environmental distractions that could hinder digestion. Collectively, these principles establish a comprehensive behavioural framework for healthy eating and extends beyond the nutritional composition of food.

Physiologically the principles of *Ahara Vidhi Vidhana* are aimed at efficient digestion, absorption of nutrients, endocrine regulation, gastrointestinal motility and metabolic homeostasis. The concept of Agni in Ayurveda, which is seen as the main determinant of digestion and metabolism, can be viewed as a representation of the total functional capabilities of digestive enzymes, gastrointestinal physiology, endocrine regulation, nutrient assimilation, and cellular metabolism. Likewise, recommendations for regular meal times, sufficient periods of fasting, appropriate portions of food and mindful eating are all behavioral approaches that support optimal digestive physiology and metabolic efficiency. All these together help to keep things in balance, keep the digestive system healthy and reduce metabolic stress.

A conceptual similarity is observed between several principles described under *Ahara Vidhi Vidhana* and chrononutrition in modern science. Both systems recognize that the timing of food intake influences digestion and metabolism. The *Ayurvedic* suggestion of Kala Bhojana conceptually corresponds to the regular meal timing recommended in chrono-nutrition and Jirne Ashniyat resembles the physiological significance of appropriate feeding-fasting intervals. Matravat Ashniyat also advocates balanced energy intake and Tanmana Bhunjita is in agreement with current concepts of mindful eating and behavioral nutrition. Although these similarities should not be taken as scientific equivalence, they do suggest that the traditional *Ayurvedic* dietary principles and modern chrononutrition are addressing similar physiological processes using different conceptual frameworks.

Recent advances in circadian physiology and chrononutrition provide an opportunity to view classical *Ayurvedic* dietary principles through a contemporary biological lens. Recent studies have linked optimal meal timing, maintenance of digestive efficiency, sufficient fasting duration and behavioral control during food intake to improved metabolic regulation, glucose homeostasis, insulin sensitivity and reduced cardiometabolic risk. The observations point to the biological relevance of selected principles of *Ahara Vidhi Vidhana* within the framework of circadian physiology and metabolic regulation. Therefore, the combination of modern biological evidence with classical *Ayurvedic* dietary wisdom might contribute to an improved interdisciplinary understanding, offer novel insights for preventive nutrition, and lead to testable hypotheses for future research in lifestyle medicine and metabolic health.

Comparative Biological Perspective of Chrononutrition and Ahara Vidhi Vidhana:

Recent advances in chronobiology

have focused on aligning dietary behavior with endogenous circadian rhythms to optimize metabolic health. Chrononutrition highlights that the timing of food intake, in addition to the composition of the diet, has a substantial impact on glucose homeostasis, hormonal regulation, digestive physiology and energy metabolism. Interestingly, many of the dietary principles described in *Ahara Vidhi Vidhana* have striking conceptual similarities with these modern biological concepts. Both Ayurveda and chrononutrition, despite having different epistemological backgrounds, agree that adequate dietary behavior is essential for physiological homeostasis and disease prevention.

One of the most apparent similarities is the concept of meal timing. Chrononutrition suggests consuming food during the biologically active phase to ensure synchronization between the central and peripheral circadian clocks. Likewise, the *Ayurvedic* concept of Kala Bhojanaa promotes eating at the right time according to the body's physiological state, thus facilitating efficient digestion and metabolic balance. In the same vein, the principle of Jirne Ashniyat, which suggests eating only after the previous meal is fully digested, corresponds to the chrononutritional emphasis on maintaining appropriate feeding–fasting cycles to promote metabolic recovery and digestive efficiency.

Another key area of convergence is the regulation of food intake and eating behavior. Current nutritional science recognizes that metabolic dysfunction can be associated with excessive caloric intake, irregular meal frequency and constant snacking. In Ayurveda, Matravat Ashniyat is to take food in a suitable amount according to the digestive capacity. Whereas Tanmana Bhunjita is to eat food with awareness without any psychological distraction. These principles are in conceptual agreement with current evidence for portion control, behavioral nutrition, appetite control and the gut–brain axis.

In *Ayurvedic* physiology the concept of *Agni* is central and is considered a major determinant of digestion and metabolism. Although there is no direct equivalent of *Agni* in modern biology, it is understood to embody the integrated functional capacity of gastrointestinal digestion, enzymatic activity, endocrine regulation, nutrient absorption and cellular metabolism. Contemporary research indicates that many of these physiological processes have circadian variation and are influenced by time of meals, supporting significant conceptual parallels between *Agni* and modern metabolic regulation.

However, it is necessary to recognize that although these similarities exist, Ayurveda and chrononutrition are separate knowledge systems with different theoretical bases. "The similarities described in this review are to be interpreted as conceptual and physiological parallels, not as direct scientific equivalence. Such an approach promotes interdisciplinary dialog, without compromising scientific integrity, and respecting the specific framework of each discipline.

Taken together, these observations indicate that integration of circadian physiology, chrononutrition and the *Ayurvedic* principles of *Ahara Vidhi Vidhana* offers a holistic biological perspective on dietary behavior. This integrated framework may guide future

translational research, contribute to the scientific understanding of classical *Ayurvedic* dietary practices, and facilitate the development of evidence-informed dietary strategies for the improvement of metabolic health and the prevention of lifestyle-related diseases.

The present review critically examined the contemporary evidence on chrononutrition as well as circadian physiology and discussed their conceptual relationship with the *Ayurvedic* principles of *Ahara Vidhi Vidhana*. The literature reviewed in this article shows that the timing of meals is a key regulator of metabolic homeostasis, affecting glucose metabolism, hormonal secretion, digestive physiology and energy balance. Recent advances in chronobiology have shown that matching food intake to endogenous circadian rhythms is important for metabolic health, whereas circadian misalignment due to irregular eating patterns is associated with obesity, insulin resistance, metabolic syndrome and cardiovascular diseases. These observations emphasize that dietary recommendations should take into account not only the nutritional quality and quantity but also the temporal organization of food intake.

One of the most significant observations of the present review is the conceptual convergence between chrononutrition and the *Ayurvedic* principles of *Ahara Vidhi Vidhana*. Classical *Ayurvedic* recommendations like Kala Bhojana (timing of meals), Jirne Ashniyat (digestive readiness), *Matravat Ashniyat* (appropriate food quantity), and *Tanmana Bhunjita* (mindful eating) emphasize the importance of meal timing, digestive readiness, appropriate food quantity, and mindful eating. These principles are conceptually consistent with current evidence for circadian aligned eating, feeding–fasting cycles, portion control and behavioral nutrition. However, these similarities should be seen as physiological analogies rather than direct scientific equivalences, because Ayurveda and modern biology are based on different theoretical frameworks. Such a balanced interpretation improves interdisciplinary understanding without sacrificing scientific rigor.

The review further showed that Agni, a key concept in *Ayurvedic* physiology, may be understood from a biological perspective as the integrated functional capacity of digestion, absorption of nutrients, endocrine regulation and metabolic activity. Modern physiology has no direct molecular equivalent of Agni, but there is increasing evidence that many digestive and metabolic processes vary with the time of day and are influenced by the timing of meals. This gives a rational scientific basis to explore traditional *Ayurvedic* dietary concepts within the framework of circadian physiology and chrononutrition.

The integrative view presented in this review is relevant to preventive nutrition, lifestyle medicine and metabolic health. Incorporating appropriate meal timing, regular eating patterns, adequate fasting intervals and mindful dietary behavior into nutritional recommendations may help improve metabolic regulation and reduce the risk of lifestyle-related diseases. Furthermore, this multidisciplinary approach could facilitate collaborative research by merging modern biological sciences with traditional medical knowledge, leading to the development of evidence-based dietary strategies.

However, despite these observations, some limitations should be kept in mind. The review is based on published scientific literature and classical texts of Ayurveda and is not a quantitative synthesis or meta-analysis. The comparison between chrononutrition and *Ahara Vidhi Vidhana* is largely conceptual and interpretive. There is thus no evidence to date that allows for direct biological equivalence to be demonstrated. Future experimental, translational and clinical research should examine the physiological mechanisms underlying these conceptual similarities, and their clinical relevance for different populations.

Overall, the present review offers a holistic biological perspective on the correlation of chrononutrition, circadian physiology and the *Ayurvedic* principles of *Ahara Vidhi Vidhana*. It provides an interdisciplinary approach, combining modern scientific evidence with traditional dietary wisdom, that might inspire further research, improve scientific understanding of traditional dietary practices, and contribute to the advancement of evidence-based nutritional approaches to promote metabolic health and prevent lifestyle-related diseases.

Inference :

Chrononutrition has emerged as a significant area of nutritional science due to its focus on the importance of the timing of food intake as a key determinant of metabolic health. Today's evidence suggests that aligning dietary behaviour with circadian physiology enhances glucose management, endocrine activity, digestive efficiency and general metabolic balance. The results expanded the understanding of nutrition to include the physiological importance of meal timing in addition to the quality and quantity of food.

The present review indicates that some principles of *Ahara Vidhi Vidhana* like *Kala Bhojana*, *Jirne Ashniyat*, *Matravat Ashniyat* and *Tanmana Bhunjita* have profound conceptual resemblances with modern chrono-nutrition. The theoretical base of *Ayurveda* and modern biological sciences are different, but both give importance to proper dietary behaviour for maintaining physiological balance and health. Interdisciplinary perspectives that reinterpret these traditional concepts through the lens of circadian physiology are valuable, but not with assumptions of direct scientific equivalence.

In conclusion, this review provides an integrative biological framework linking circadian physiology, chrononutrition and *Ayurvedic* dietary principles. This approach can contribute to the scientific understanding of classical *Ayurvedic* knowledge, foster interdisciplinary research, and support the development of evidence-informed dietary strategies to enhance metabolic health and prevent lifestyle-related disorders. These conceptual relationships need to be examined by further experimental and clinical research, and their practical implications need to be assessed.

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